A Nonlinear Adaptive Approach to Isolation of Sensor Faults and Component Faults, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

Impact Technologies, LLC in collaboration with Wright State University and Pratt & Whitney, propose to develop innovative methods to differentiate sensor failure from actual system or component failure for advanced propulsion systems. In sharp contrast to many conventional methods which deal with either sensor failure or component failure but not both, our method considers sensor failure and component failure under one systematic and unified framework. The proposed solution consists of two main components: a bank of real-time nonlinear adaptive fault diagnostic estimators for residual generation and a Transferable Belief Model (TBM) based component for residual evaluation. By employing a nonlinear adaptive learning architecture, the presented approach is capable of directly dealing with nonlinear engine models and nonlinear faults without the need of linearization. Fault sensitivity and robustness to modeling uncertainty is enhanced by several important techniques including adaptive reference nonlinear engine model, adaptive diagnostic thresholds, and TBM based residual evaluation method. Software modules will be developed and integrated into the NASA C-MAPSS engine model for performance evaluation. A subset of core algorithms will be implemented and used in a hardware-in-the-loop demonstration under dSPACE environment to justify a Technology Readiness Level of 4-5 at the conclusion of Phase I.

Primary U.S. Work Locations and Key Partners
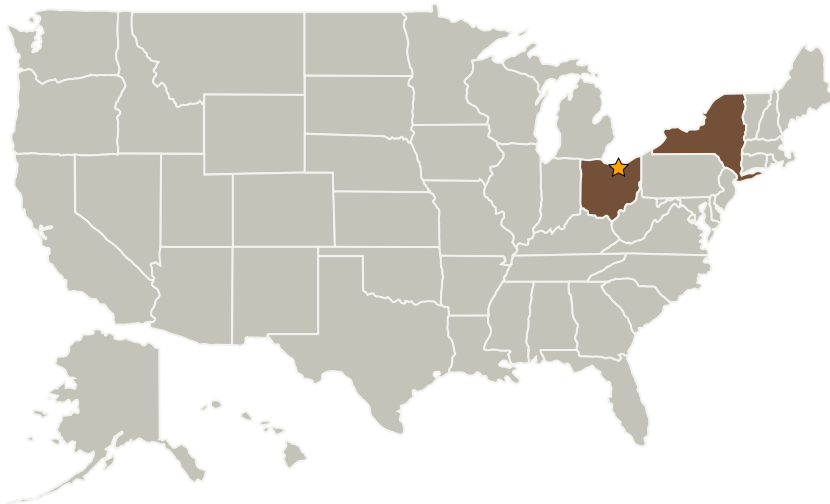
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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Organizations Performing Work	Role	Type	Location
⭐Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Impact Technologies, LLC	Supporting Organization	Industry	Rochester, New York

Primary U.S. Work Locations	
New York	Ohio

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Technology Areas

Primary:

- TX10 Autonomous Systems
  - └ TX10.2 Reasoning and Acting
    - └ TX10.2.5 Fault Diagnosis and Prognosis

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